

Malagarion paenelimax gen. nov., spec. nov.,
A New Slug-like Helicarionid from Madagascar

(Pulmonata : Helicarionidae)

BY

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(8 Text figures)

INTRODUCTION

SINCE 1949, Pr E. FISCHER HAS BEEN forming a collection of land snails from Madagascar in the MNHN. This collection now amounts to more than 10 000 lots and is probably the most important in the world for this region; Pr Fischer published more than 30 papers dealing with this material between 1949 and 1977. Most of the material consists of dried shells, but in the small suite of specimens preserved in liquid was found the new Helicarionid here described, which was given by Mrs. F. Blanc who collected it during the 1972 CNRS-RCP 225 expedition in the Marojezy Mountains in the northeast of Madagascar.

Malagarion Tillier, gen. nov.

Diagnosis: A helicarionid with a much reduced shell (less than 2 whorls and almost completely uncalcified) completely covered by the mantle which has no distinct lobes; visceral cavity not entering the posterior part of the foot which is depressed by the visceral hump lying on it. Genital apparatus without a sarcobelum; penis with a penial sheath joining the epiphallus, a flagellum and a short retractor caecum on the outer side of the angle between penis and epiphallus; lower part of the free oviduct inflated and isolated from the upper part by a papilla; vagina and atrium much reduced. Radula with teeth small, very numerous and close-set; the central unicuspid, a few laterals tricuspid and the marginals very numerous (about 300 per half row) and bicuspid.

Type Species: *Malagarion paenelimax* Tillier, spec. nov.

Malagarion paenelimax Tillier, spec. nov.

Material: The holotype.

Type Locality: Marojezy Mountains, 600 m; 12 December 1972; F. Blanc coll. et leg., MNHN.

External Morphology: (Figure 1) Animal 28 mm long in alcohol with a tail 17 mm long and a narrow foot (2.5 mm wide). The visceral hump, completely covered by the mantle without any pore, lies in a triangular depression on the anterior part of the tail (on the holotype this depression is probably accentuated by the position of the animal). The mantle forms a nuchal shield extending forward about halfway to the ocular tentacles. The tail is truncated, without prominent horn, split by the caudal gland which is about as deep as high and triangular in vertical section. The pedal sole is tripartite and limited by a lateral pedal groove. The tegument of the foot is reticulated, with nuchal grooves hardly visible; the reticulation is interrupted above the pedal groove and at a short distance from the truncated posterior end. The mantle is covered with granules which become larger and conical on the back of the visceral hump. The colour in liquid is whitish with the upper part of the mantle and tail finely punctulated with pink, and the nuchal region creamy.

Internal Morphology: The shell has about 1.5 whorls. It is reduced to a horny membrane, except in its last 0.5 whorl where it is slightly calcified with thin concentric growth lines. It is impossible to remove it without breaking either the periostracum or the mantle edge.

The Body Cavity (Figure 2) does not extend at all into the posterior part of the foot. The oesophagus and

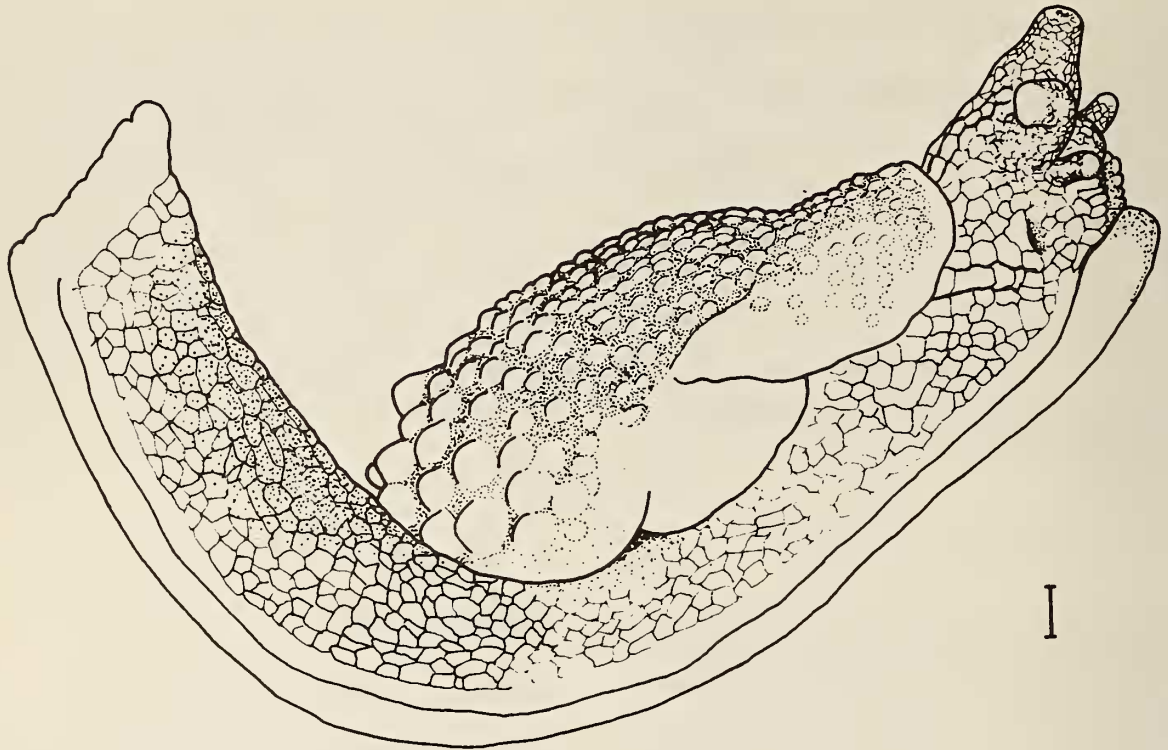


Figure 1

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Habitus of the holotype

(scale: 1 mm)

the enlarged crop lie on the left side, partially embedded in the folds of the oviduct which lies on the right side together with the penis and the bursa copulatrix. The stomach and intestine make 3 loops in the visceral mass, which contains the albumen gland in its concavity and the ovotestis at its extremity.

The free Retractors have 3 insertions along the ligamental back edge of the body cavity; from left to right:

- The left tentacular retractor crosses over the crop and then lies along the left side of the anterior digestive tract;
- The buccal retractors have a large common stem which divides into 2 branches passing through the nerve ring and inserting below the buccal mass;
- The right tentacular retractor runs between the anterior digestive tract and the genital apparatus; it lies on the left side of the latter for its entire length.

The Pallial Complex (Figures 3 and 4) occupies the left anterior half of the visceral hump; kidney, heart and rectum are parallel in a diagonal direction, from the left posteriorly to the right anteriorly. The kidney, very long, is posteriorly reflected into a lobe itself folded in such a way that it is applied to the pericardium on one side and to the second loop of the intestine on the other. The ureter, about of the same diameter as the intestine, overlaps the direct lobe of the kidney before turning back along the rectum; the latter is inflated just anterior to the anus. The external opening is an oblique slit which is divided by a vertical pillar into posterior anus and anterior upper pneumostome and lower kidney pore.

Genital Apparatus: (Figures 5, 6, 7) The small ovotestis is subspherical, blackish and formed by numerous acini. The hermaphrodite duct, rather short, becomes

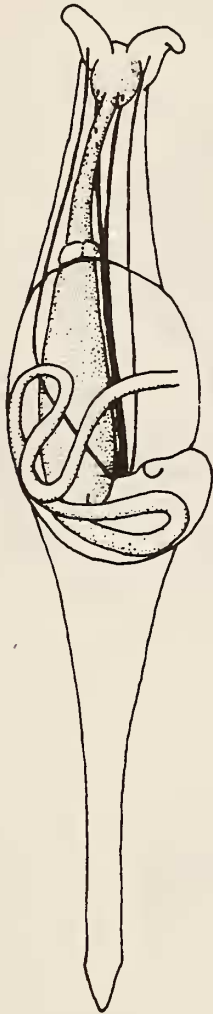


Figure 2

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Disposition of the digestive tract and of the free retractors (rhizophoral branches of the tentacular retractors not depicted)

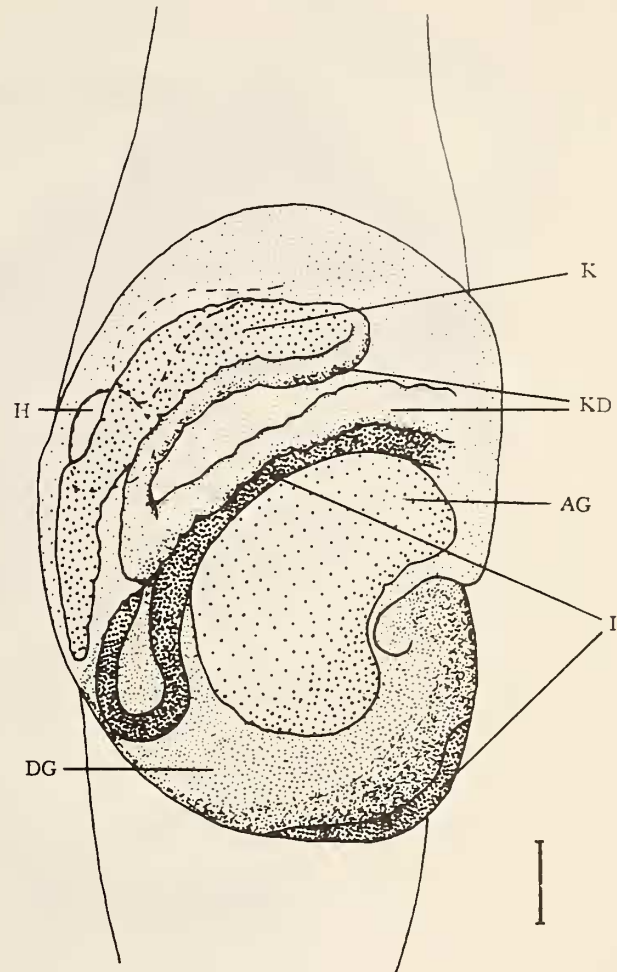


Figure 3

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Disposition of the organs in the visceral hump, upper view
 AG - albumen gland DG - digestive gland H - heart
 I - Intestine K - kidney KD - Kidney duct
 (scale: 1 mm)

broader and twisted in its distal part. It opens into the spermoviduct at the base of a short and broad talon applied on the concave side of the albumen gland. The spermoviduct is subcircular in section in its first half, but in its second half the oviduct forms large flat expansions in which the anterior digestive tract is partially embedded *in situ*. The free oviduct is divided into 3 sections: the first

has a thick orange wall and is probably glandular; the second is a simple tube which opens by a prominent constricted papilla into the third. The latter, which may be involved either in the secretion of the shells of the eggs or, by analogy with *Colparion*, in their incubation, is a greyish, thick walled and curved pouch and has a large and internally folded opening at the base of the bursa

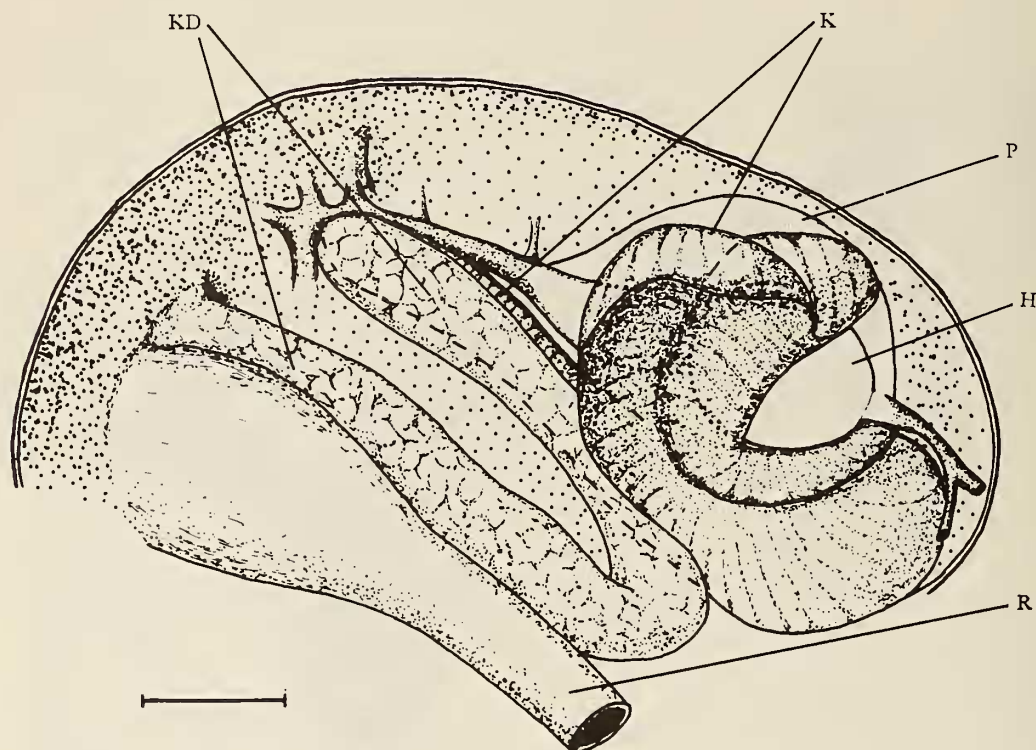


Figure 4

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Pallial complex, lower view H - heart K - kidney
 KD - kidney duct P - pericardium R - rectum
 (scale: 1 mm)

copulatrix. Except for these few folds and the papilla, the inner wall of the oviduct is smooth.

The bursa copulatrix is rather short and finger-like. Its inner wall is smooth in its inferior third, and has transverse regular folds in its upper two thirds. The oviduct and the bursa copulatrix open without a distinct vagina into the genital atrium, which is reduced as much as possible and internally smooth.

The penial complex (Figures 6 and 7) has a sheath, a short retractor caecum inserted on the outer side of the angle between penis and epiphallus, and a flagellum. The epiphallus and flagellum are bent back along the penis, the former being connected to the penial sheath by a tract.

The penis is divided into 2 subequal parts by a penial papilla. Just above and below this papilla the penis is inflated and internally granulous whereas it is tubular with internal longitudinal folds in its lower and upper parts. Just below the penial papilla a second papilla is inserted; it is folded and triangular when flattened. The penis has 2 sheaths: the lower one, thicker and with circular fibres in its lower part, encloses the lower tubular part of the penis and is joined to the epiphallus by a thin connective tract; the upper penial sheath is much thicker and encloses only the upper bulbous part of the penis. The caecum prolongs the penis and is bent along the epiphallus; it is short, not coiled, thin walled and has internal longi-

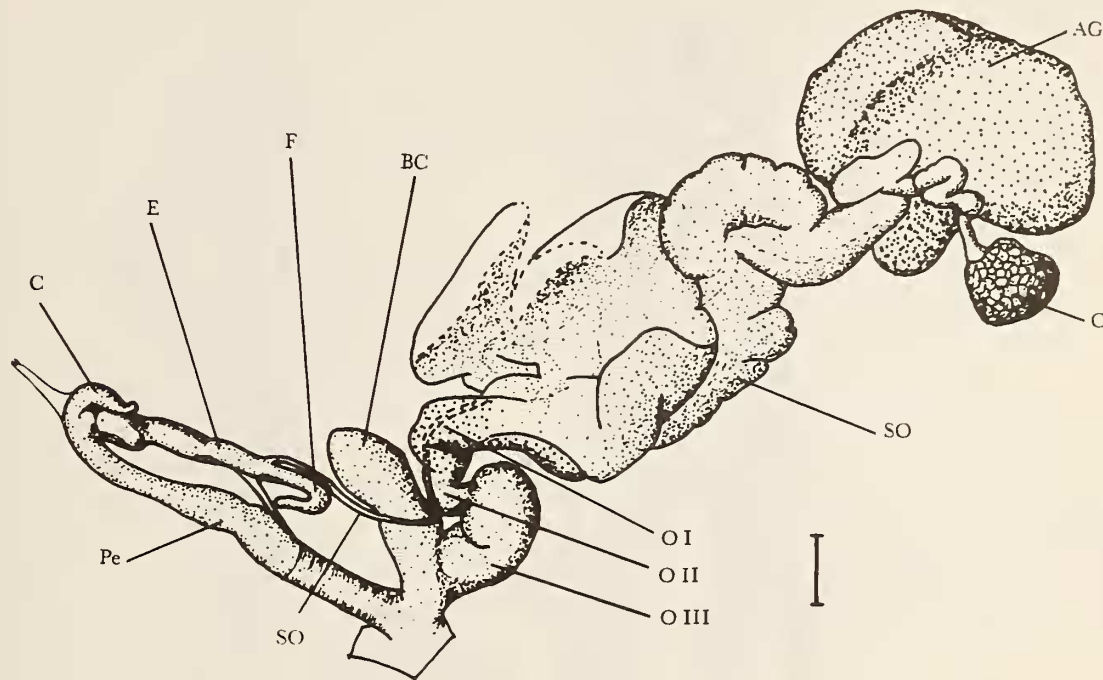


Figure 5

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Genital apparatus:	AG - albumen gland	BC - bursa copulatrix
C - caecum	E - epiphallus	F - flagellum
HD - hermaphrodite duct	OI, OII, OIII - sections of the free oviduct	
Pe - penis	SO - spermoviduct (scale: 1 mm)	

tudinal folds, except in its basal region where the folds are honeycomb-like. The epiphallus opens into the penis at the base of the caecum by a narrow and prominent papilla. Its inner wall is also longitudinally folded except around the opening of the vas deferens where it is smooth. It is bent in its thin sheath which adheres to its wall at the convexity of the bends. The flagellum is a hollow tube, internally smooth, with its axial cavity occluded by a rod which is cylindrical near its fixed extremity and then flattened with its free end enlarged; such a structure was previously described by VAN MOL (1968, 1970). The extremity of the flagellum is bent back, with a thin sheath visible in the convexity of the bend.

No horny spermatophore was found, but the bursa copulatrix was filled with whitish, soft fragments; on the other hand, the epiphallus contained a mass of the same

material which disintegrated when dissected. This suggests, but does not prove, the occurrence of a soft spermatophore; if a horny spermatophore is found later on, it will probably be smooth as a result of the absence of crypts in the inner wall of the flagellum.

The Radula (Figure 8) is formed by 132 V-shaped rows, with an angle of about 130° , and more than 600 teeth per row; formula:

$$(300 \pm 15) \cdot (3 - 6) \cdot C \cdot (3 - 6) \cdot (300 \pm 15).$$

All the teeth have very long basal plates, nearly extending to the extremity of the cusps and parallel to the upper plates. The central is unicuspid, elongated, about $30 \mu\text{m}$ long. The lateromarginals are elongated too, very tight and slightly sigmoid, becoming progressively smaller when approaching the end of the rows. The first ones are tri-

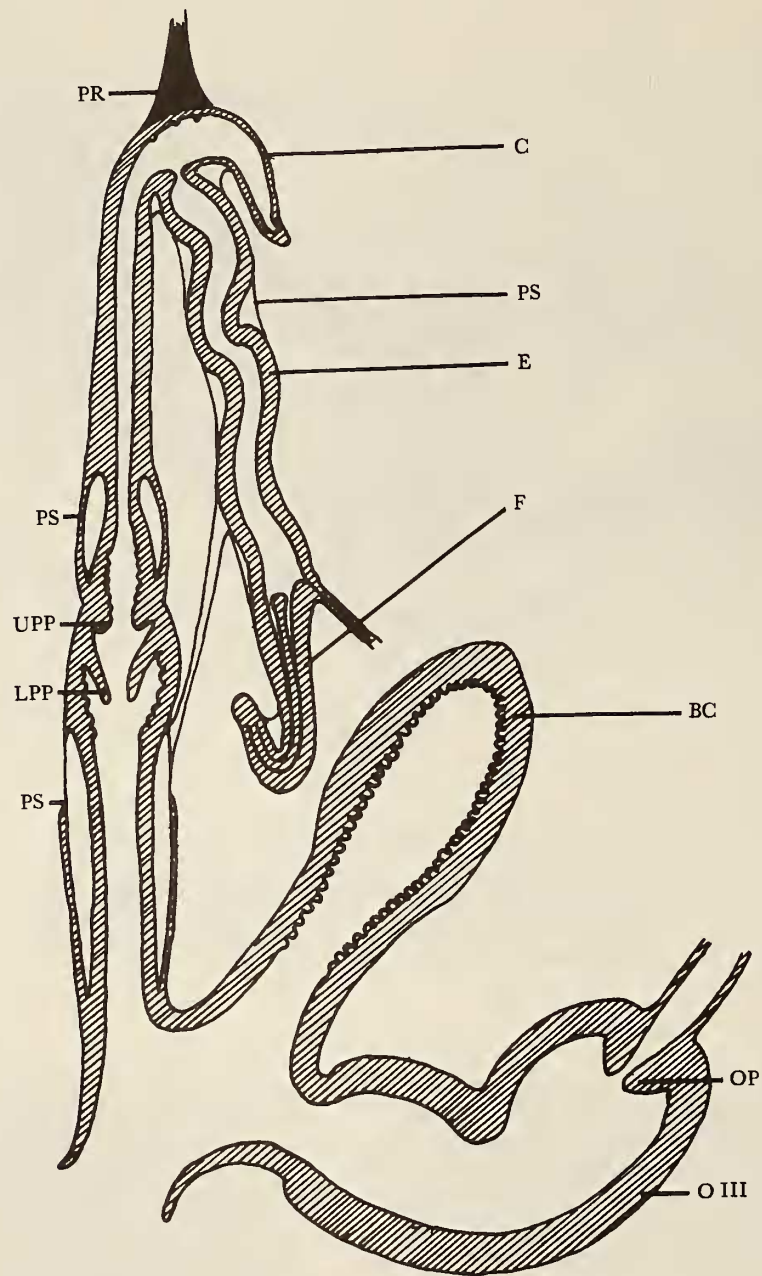


Figure 6

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Longitudinal section of the lower genitalia: BC - bursa copulatrix C - caecum E - epiphallus F - flagellum OIII - lower section of the free oviduct PR - penial retractor PS - penial sheath OP - papilla of the oviduct UPP - upper penial papilla LPP - lower penial papilla

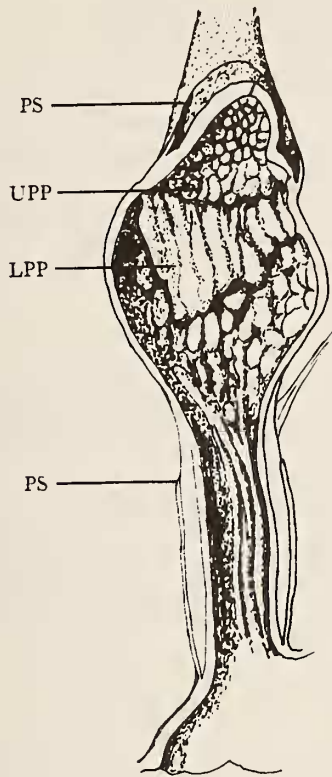


Figure 7

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Lower penis opened and flattened: PS - penial sheath
 UPP - upper penial papilla LPP - lower penial papilla

cuspid with a large mesocone; then the endocone disappears and at the same time the ectocone becomes larger than the mesocone. This feature is preserved as far as the last and smallest marginals.

The conical papillae of the mantle showed a spongy structure when cut under the binocular microscope. Histological preparations exhibited numerous lacunae within them; these lacunae open outwards by numerous pores on each papilla. Unfortunately the animal was too badly fixed to allow further histological investigations, but it seems that these lacunae are reservoirs for a liquid which may be exuded: it could be a repellent material, not uncommon in zonitoid snails; but this is only a hypothesis.

Ecology: The Marojezy is one of the best preserved Malagasy mountains; its isolation prevented its slopes from being burnt like those of other mountains. It has the greatest rainfalls in Madagascar. At the altitude of 600 m, where *Malagarion paenelimax* was found, its slopes are covered by evergreen rain forest. Complete data concerning rainfalls, temperature and insolation of the collecting station may be found, with additional references about the Marojezy and its vegetation, in GUILLAUMET *et al.* (1972).

DISCUSSION

The only species related to *Malagarion paenelimax* seems to be *Colparion madgei* Laidlaw, 1938, only species of the genus, described from Rodrigues Island. They have mainly in common a reduced shell and the lack of a sarcobellum, but they show some other similar trends: they have

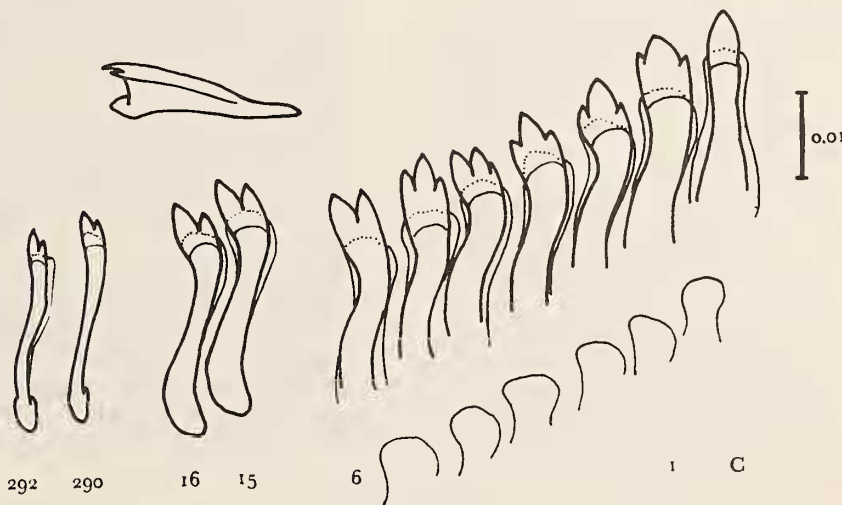


Figure 8

Malagarion paenelimax Tillier, gen. nov., spec. nov.

Radula: on the upper left, side view of a marginal tooth (about the 200th)

the number of teeth per row larger than is common in the helicarionids and larger than in any known Malagasy species (250 in *Colparion* and 600 in *Malagarion*); both have a similar penial organization, with a long flagellum, a short retractor caecum inserted in the same way and with a penial sheath (although not mentioned by Laidlaw, a penial sheath seems to occur in his figs. 1 - 2). Their external appearance seems also to be similar, with nuchal grooves only slightly marked and the tail depressed under the visceral mass which does not extend backward into the foot. However, their differences, in particular in the degree of overlapping of the shell by the mantle and in the radula, do not allow assigning them to a single genus.

The genus *Colparion* was placed by BAKER (1941), whose classification as modified by SOLEM (1966) is followed here, among the Helicarioninae on the basis of the lack of a sarcobelum; but now we know that this is not a suitable character for the determination of the systematic position, and that a sarcobelum can appear independently in parallel lineages (VAN MOL, 1970); so the position of *Colparion* and *Malagarion* has to be discussed here.

These two genera cannot be placed among the Urocyclinae (= Trochozonitinae + Urocyclinae auct.: the works of van Mol and van Goethem clearly show that the classical distinction cannot be maintained); independently of the structure of the sarcobelum, the Urocyclinae show after van Mol (*in lit.*) slight but constant differences from the other helicarionids: in particular their penial sheath always joins the penis above the penial papilla and, when the shell is reduced, the visceral cavity extends into the caudal region (except in *Tresia* and *Leptichnus*, cf. VAN GOETHEM, 1977).

Neither of our two genera shows any of these features, but on the contrary they show striking similarities with various Ariophantinae: gross organization of the penial complex (cf. *Macrochlamys* VAN MOL, 1968); organization of the penial sheath (cf. *Sesara* and the Girasii, SOLEM, 1966; Madagascan *Kalidos*, van Mol, *in lit.*); presence of two papillae in the penis (*Oxytes*, BAKER, 1941; *Megaustenia*, SOLEM, 1966); large number of radular teeth per row (cf. the Durgelli). At first glance the radula and the reduction of the shell suggest affinities with the Durgelli; however, the latter show a constant penial organization, without any flagellum and with the penial retractor close to the vas deferens, which is quite different from that of *Colparion* and *Malagarion*. In spite of some similarities it seems also difficult to place

our two genera among the Girasii, which have an epiphallic retractor caecum, a different reflexion of the penial complex from the penial retractor and usually a blunt flagellum. Whatever tribe, as defined by SOLEM (1966), is considered, *Malagarion* shows features too aberrant to be classified in one of them as far as known intermediate forms are lacking. At the moment it seems best to consider *Colparion* and *Malagarion* as representative of a Malagasy lineage parallel to the other tribes of the Ariophantinae and possibly originating in the Macrochlamydi, which have both plesiomorphic characters and a diversity in the organization of the penial complex greater than in other tribes; but this view is only tentative and needs to be confirmed by further anatomical investigations of the Malagasy Ariophantinae.

ACKNOWLEDGMENTS

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Literature Cited

- BAKER, HENRY BURRINGTON
1941. Zonitid snails from Pacific Islands. Parts 3 and 4. Bernice P. Bishop Mus., Bull. 166: 370 pp.; pls. 43-61; 8 tables
- FISCHER-PIETTE, EDOUARD, JACQUELINE BEDOUGHA & FRANCINE SALVAT
1966. Mollusques terrestres de Madagascar. Ariophantinae. Mem. Mus. Natn. Hist. nat. 40 (1): 50 pp.; 6 pls.; 12 text figs.
- GUILLAUMET, JEAN L., JEAN MARIE BETSCH, CHARLES BLANC, P. MORAT, A. PEYRIERAS & RENÉ PAULIAN
1975. Étude des écosystèmes montagnards dans la région malgache. III. Le Marojezy. IV. L'Itemo et l'Ibity. Géomorphologie, climatologie, faune et flore (Campagne RCP 225, 1972-1973). Bull. Mus. Natn. Hist. nat. (3) 309 (Écologie générale): 29-67; 12 text figs.
- LAIDLAW, FRANK FORTESCUE
1938. A new genus and species of the Ariophantinae from the island of Rodriguez. Mauritius Inst. Bull. 1 (3): 9-12; 1 text fig.; pl. 3, figs. 8-10
- SOLEM, ALAN
1966. Some non-marine mollusks from Thailand, with notes on the classification of the Helicarionidae. Spolia zool. Mus. haun. 24: 110 pp.; 3 pls.; 24 text figs.
- VAN GOETHEM, JACKIE
1977. Révision systématique des Urocyclinae (Mollusca, Pulmonata, Urocyclidae). Ann. Mus. Roy. Afr. centr. (8°) 218: 353 pp.; 719 figs.; 4 pls.; tables
- VAN MOL, JEAN-JACQUES
1968. Notes anatomiques sur les Helicarionidae (Gastéropodes Pulmonés). I. Étude des genres *Macrochlamys*, *Parmarion* et *Xesta*. Ann. Soc. Roy. zool. Belgique 98 (3): 189-215; 13 text figs.
1970. Révision des Urocyclidae (Mollusca, Gastropoda, Pulmonata). Première partie. Ann. Mus. Roy. Afr. centr. (8°) 180: 234 pp.; 158 text figs.
1970. Anatomical studies in the families Urocyclidae and Helicarionidae: Pulmonata, Stylommatophora. Amer. Malacol. Union, Ann. Rpts. for 1970: 57-58